PV Inverter

SUNNY BOY 1200/1700

Installation Guide

SB12_17-IEN104650 | IMEN-SB11_17 | Version 5.0

EN

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1 Notes on this Manual

1.1 Scope of Validity

This manual describes the assembly, installation, commissioning and maintenance of the following SMA inverters:

- Sunny Boy 1200 (SB 1200)
- Sunny Boy 1700 (SB 1700)

Store this manual where it can be accessed at all times.

1.2 Target Group

This manual is for qualified personnel. The tasks described in this manual may only be performed by qualified personnel.

1.3 Additional Information

You will find further information on special topics such as designing a line circuit breaker or the description of the operating parameters in the download area at www.SMA.de/en.

Refer to the user manual for detailed information on operating the inverter.

1.4 Symbols Used

The following types of safety precautions and general information are used in this manual:

DANGER!

"DANGER" indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING!

"WARNING" indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION!

"CAUTION" indicates a hazardous situation which, if not avoided, could result in minor or moderate injury!

NOTICE!

"NOTICE" indicates a situation that can result in property damage, if not avoided.

Information:

Information provides tips that are valuable for the optimal installation and operation of your product.

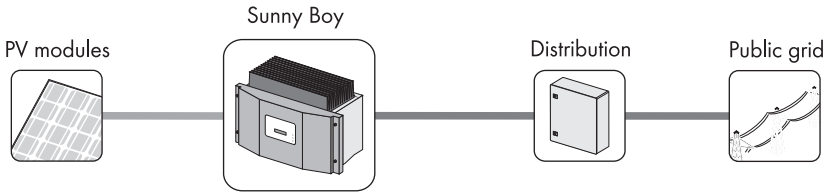
☑ This symbol indicates the result of an action.

2 Safety

2.1 Appropriate Usage

The Sunny Boy is a PV inverter, which converts the DC current of the PV generator to AC current and feeds it into the public grid.

Principle of a PV plant with this Sunny Boy



The Sunny Boy may only be operated with PV generators (modules and cabling) of protection class II. Do not connect any sources of energy other than PV modules to the Sunny Boy.

When designing the PV system, ensure that the values comply with the permitted operating range of all components at all times. The free design program "Sunny Design" (www.SMA.de/en/SunnyDesign) will assist you. The manufacturer of the PV modules must have approved the modules for use with this Sunny Boy device. You must also ensure that all measures recommended by the module manufacturer for long-term maintenance of the module properties are taken (see also Technical Information "Module Technology", in the download area of www.SMA.de/en).

Do not use the Sunny Boy for purposes other than those described here. Alternative uses, modifications to the Sunny Boy or the installation of components not expressly recommended or sold by SMA Solar Technology AG void the warranty claims and operation permission.

Certified Countries

The Sunny Boy 1200/1700 (with according configuration) fulfill the requirements specified in the following standards and directives (dated: 12/2010):

SB 1200

- AS4777 (2005)
- C10/C11 (05.2009)
- CER/06/190 (10.2006)*
- DK 5940 Ed.2.2 (02.2006)**
- EN 50438:2008***
- G83/1-1:2008
- IEEE929
- PPC:2006
- PPDS:2009
- RD 1663/2000 (2000)
- RD 1663/661
- VDE 0126-1-1 (02.2006)
- UTE C15-712-1****

SB 1700

- AS4777 (2005)
- C10/C11 (05.2009)
- CER/06/190 (10.2006)
- DK 5940 Ed.2.2 (02.2006)**
- EN 50438:2008***
- G83/1-1:2008
- IEEE929
- PPC:2006
- PPDS:2009
- RD 1663/2000 (2000)
- RD 1663/661
- VDE 0126-1-1 (02.2006)
- UTE C15-712-1****

* On request

** only applies to SB 1200-IT/SB 1700-IT

*** does not apply to national standard deviations of EN 50438

**** Firmware version 3.06 and higher

SMA Solar Technology AG can preset special grid parameters for other countries/installation locations according to customer request, after evaluation by SMA Solar Technology AG. You can make later modifications yourself by changing software parameters with respective communication products (e.g. Sunny Data Control or Sunny Explorer) (see section 5.6 "Setting the Grid and Country Parameters" (page 35)). To change grid-relevant parameters, you need a personal access code - the so-called SMA Grid Guard Code. The application form for the personal access code is located in the download area at www.SMA.de/en, in the "Certificate" category for each inverter.

2.2 Safety Precautions

DANGER!

Danger to life due to high voltages in the inverter!

- All work on the inverter may be carried out by qualified personnel only.
- The appliance is not to be used by children or persons with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction.
- Children should be supervised to ensure that they do not play with the appliance.

DANGER!

Danger of burn injuries due to hot enclosure parts.

- Do not touch enclosure during operation.
- Only touch the lid during operation.

NOTICE!

Dust and water in the Sunny Boy can damage the inverter!

Once the Electronic Solar Switch has been pulled out, the inverter only provides protection rating IP21. The inverter is then no longer protected against water and dust. In order that the protection rating IP65 is also provided during a temporary decommissioning, proceed as follows:

- Release and disconnect all DC connectors.
- Open all DC connectors and remove the cables.
- Close all DC inputs with the corresponding DC connectors and the sealing plug provided.
- Securely attach the Electronic Solar Switch again.

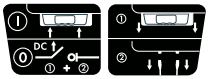
Grounding the PV Generator

Comply with the local requirements for grounding the modules and the PV generator. SMA Solar Technology AG recommends connecting the generator frame and other electricity conducting surfaces so that there is continuous conduction and to ground them in order to achieve maximum protection of the system and personnel.

2.3 Explanation of Symbols

This chapter contains an explanation of all symbols found on the inverter and type label.

2.3.1 Symbols on the Inverter

Symbol	Explanation
	Operation display. Indicates the operation condition of the inverter.
	Ground fault or varistor defective. Read section 9.3 "Red LED is Glowing Continuously" (page 55).
	Disturbance or fault. Read section 9 "Failure Search" (page 51).
	You can operate the display by tapping it: • 1 tap: the backlight is switched on, or the display switches to the next screen. • 2 taps in quick succession: the inverter shows the display messages from the initialization phase again (see section 6.2 "Display Messages during Initialization" (page 38)).
	Electronic Solar Switch (ESS) DC load disconnection unit • ❶ When the Electronic Solar Switch is plugged in, the DC circuit is closed. • ❶ To interrupt the DC circuit and disconnect the inverter securely under load, you have to first pull out the Electronic Solar Switch ❶ and then remove all DC plug connectors ❷, as described in section 7.2 "Opening the Inverter" (page 44).

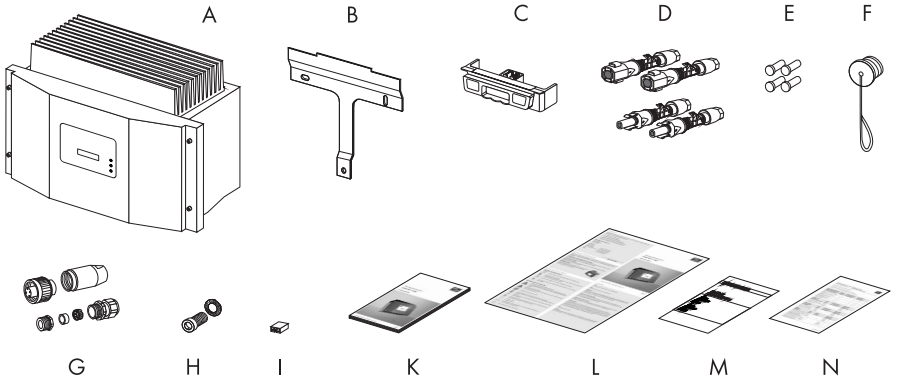
2.3.2 Symbols on the Type Label

Symbol	Explanation
	Beware of dangerous electrical voltage. The inverter operates at high voltages. All work on the inverter must be carried out by qualified personnel only.
	Beware of hot surface. The inverter can become hot during operation. Avoid contact during operation.
	Observe all documentation that accompanies the inverter.
	The inverter must not be disposed of with the household waste. For more information on disposal, see section 10.4 "Disposing of the Inverter" (page 61).
	CE mark. The inverter complies with the requirements of the applicable EC guidelines.
	The inverter has a transformer.
	Direct Current (DC)
	Alternating current (AC)
	Protection rating IP65. The inverter is protected against penetration by dust particles and water jets from any angle.
	RAL quality mark for solar products. The inverter complies with the requirements of the German Institute for Quality Assurance and Labeling.

3 Unpacking

3.1 Scope of Delivery

Check the delivery for completeness and for any visible external damage. Contact your dealer if anything is damaged or missing.



Object	Quantity	Description
A	1	Sunny Boy
B	1	Wall mounting bracket
C	1	Electronic Solar Switch (ESS)
D	4	DC plug connectors (2 x positive/2 x negative)
E	4	Sealing plugs for DC plug connectors
F	1	Protective cap for AC socket on inverter
G	1	AC connection socket: socket unit, threaded sleeve, pressure screw PG13.5, sealing ring PG13.5, fastening case PG13.5, cable gland PG16
H	1	M6x12 cylinder head screw and locking washer
I	1	Jumper
K	1	Installation guide
L	1	User manual
M	1	Set of documents with explanations and certificates
N	1	Supplementary sheet with inverter factory settings

3.2 Identifying the Inverter

You can identify the inverter by the type label. The type label is on the right side of the enclosure.

The serial number (Serial No.) and the type (Type / Model) of the product, as well as device-specific characteristics are specified on the type label.

4 Mounting the Device

4.1 Safety

DANGER!

Danger to life due to fire or explosion!

Despite careful construction, electrical devices can cause fires.

- Do not mount the inverter on flammable construction materials.
- Do not mount the inverter in areas where highly flammable materials are stored.
- Do not mount the inverter in areas with a risk of explosion.

CAUTION!

Danger of burn injuries due to hot enclosure parts.

- Mount the inverter in such a way that the enclosure cannot be touched inadvertently.

CAUTION!

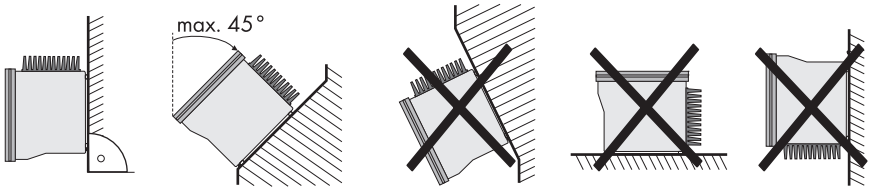
Risk of injury due to the heavy weight of the inverter.

- Take the inverter's weight of approx. 25 kg into account for mounting.

4.2 Selecting the Mounting Location

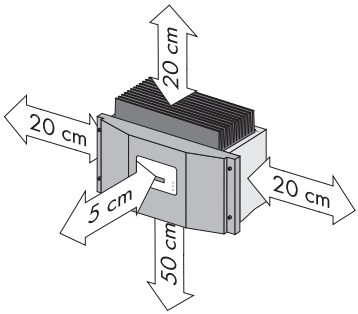
Consider the following points when selecting where to install:

- The installation method and mounting location must be suitable for the inverter's weight and dimensions (see section 11 "Technical Data" (page 62)).
- Mount on a solid surface.
- The mounting location must at all times be clear and have safe access without the use of additional aids such as scaffolding or lifting platforms. Any possible service actions are otherwise limited.



- Vertical installation or tilted backward by max. 45°.
- The connection area must point downward.
- Never install the device with a forward tilt.

- Never install the device with a sideways tilt.
- Do not install horizontally.
- Install at eye level in order to allow operating state to be read at all times.
- To ensure optimal operation, the ambient temperature should be below 40 °C.
- Do not expose the inverter to direct sunlight to avoid a power reduction due to excessive heating.
- In a living area, do not mount the unit on plasterboard walls (or similar) in order to avoid audible vibrations. The inverter can make noises when in use which may be perceived as a nuisance in a living area.
- Observe the minimum clearances to walls, other inverters or objects as shown in the diagram in order to ensure sufficient heat dissipation and sufficient space for the removal of the Electronic Solar Switch.



Multiple inverters installed in areas with high ambient temperatures

If necessary, increase the clearances and make sure there is enough ventilation to ensure sufficient cooling of the inverters.

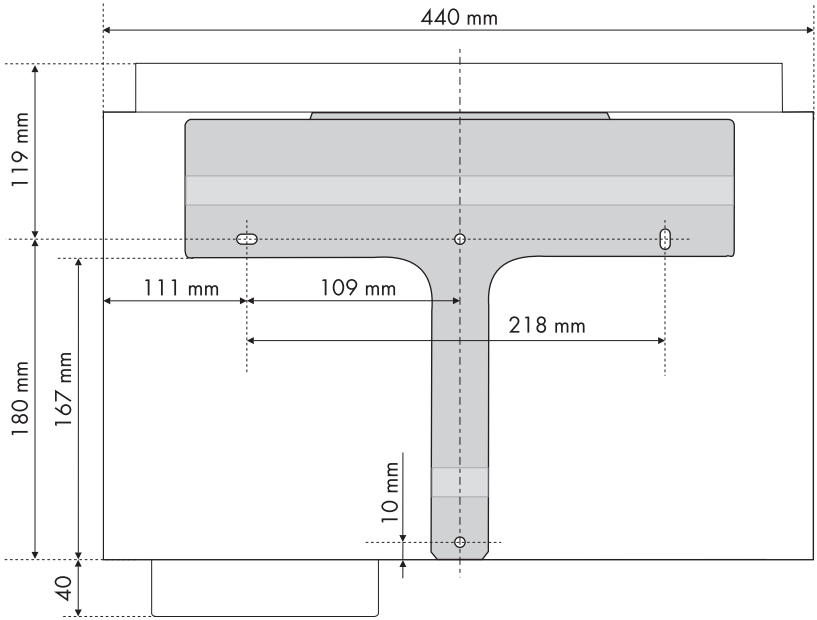
4.3 Mounting the Inverter with Wall Mounting Bracket

CAUTION!

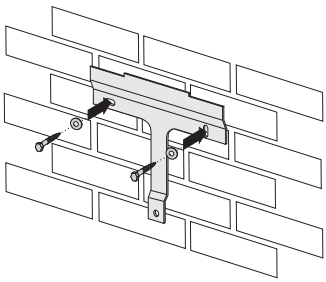
Risk of injury due to the heavy weight of the inverter.

- Take the inverter's weight of approx. 25 kg into account for mounting.
- When mounting the bracket, use fastening material suitable for the material.

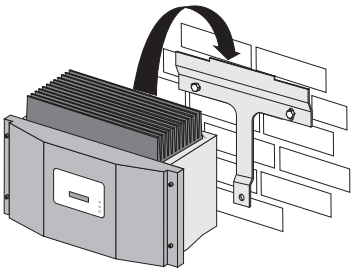
1. Use the wall mounting bracket as a drilling template and mark the positions of the drill holes.



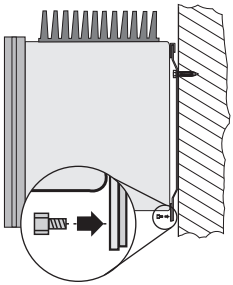
2. Attach the wall mounting bracket to the wall using appropriate screws and washers.



3. Use the upper mounting clips to fit the inverter in the wall mounting bracket so that it cannot be pushed out of the wall mounting bracket from the side.



4. If a second grounding conductor is required in the country of installation, you need to ground the inverter and secure it against being lifted out of place, as described in section 5.2.3 "Connecting additional grounding" (page 26).
5. . If a second grounding conductor is not required, secure the inverter against being lifted out of place using the enclosed M6x12 screw.



6. Check to ensure the inverter is firmly fastened.

☑ The inverter is now mounted to the wall.

5 Electrical Connection

NOTICE!

Electrostatic discharges can damage the inverter!

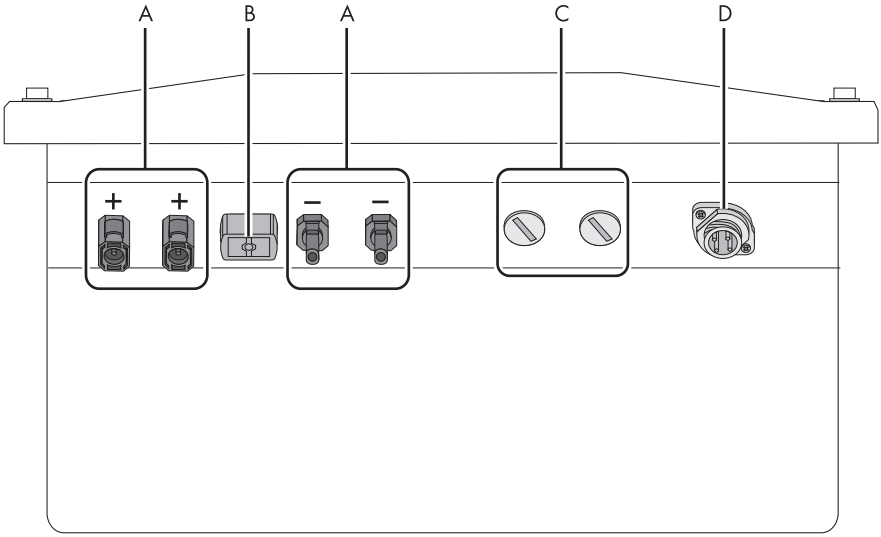
Internal components of the inverter can be irreparably damaged by static discharge.

- Ground yourself before touching a component.

5.1 Overview of the Connection Area

5.1.1 Exterior View

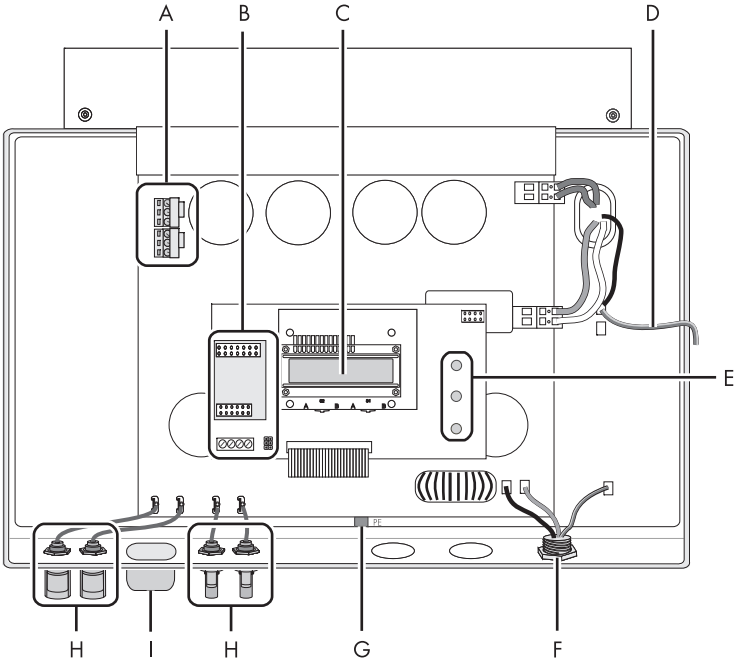
The following figure shows the assignment of the individual connection areas on the bottom of the inverter.



Object	Description
A	DC connectors for connecting the PV strings
B	Socket for connecting the Electronic Solar Switch (ESS) DC load disconnection unit
C	Enclosure opening with sealing plugs for communication
D	Socket for AC Connection

5.1.2 Interior View

The following illustration shows the various components and connection areas of the open inverter.



Object	Description
A	Varistors
B	Connection area and sockets for optional communication via RS485 or radio
C	Display
D	PE connection cable for the lid
E	Operating status LEDs
F	Socket for AC Connection
G	Tab for grounding the cable shield with RS485 communication
H	DC plug connectors
I	Electronic Solar Switch (ESS) socket

5.2 Connection to the Public Grid (AC)

5.2.1 Conditions for the AC Connection

Connection requirements of the utility operator

Comply with the connection requirements of your utility operator!

Cable Sizing

The conductor cross-sectional area should be dimensioned so output losses do not exceed 1 % at nominal power.

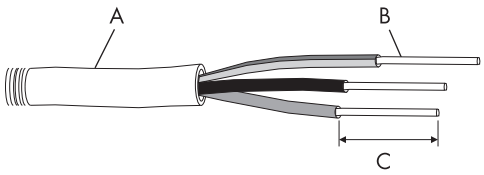
The maximum wire lengths relative to the conductor cross-section are shown in the following table.

Conductor cross-section	Maximum wire length	
	SB 1200	SB 1700
1.5 mm²	18 m	15 m
2.5 mm²	30 m	22.5 m

The conductor cross-sectional area required in individual cases depends on the following factors among others:

- Ambient temperature,
- Routing method,
- UV resistance,
- Conduction losses,
- Valid installation guidelines of the respective country (of the installation location).

Cable Requirements



Position	Description	Value
A	External diameter	9 mm ...17 mm
B	Conductor cross-section	max. 2.5 mm²
C	Strip insulation	4 mm ... 5 mm

Load Disconnection Unit

You must install a **separate** line circuit breaker for each inverter in order to ensure that the inverter can be securely disconnected under load. The maximum permissible rating is located in section 11 "Technical Data" (page 62).

Detailed information and examples for the rating of a line circuit breaker can be found in the Technical Information "Line Circuit Breaker" in the SMA Solar Technology AG download area at www.SMA.de/en.

DANGER!

Danger to life due to fire.

When more than one inverter is connected to the same line circuit breaker, the protective function of the line circuit breaker is no longer guaranteed. It can result in a cable fire or the destruction of the inverter.

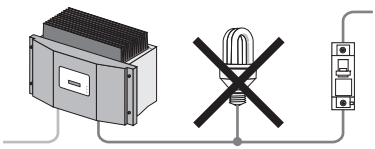
- Never connect several inverters to a single line circuit breaker.
- Comply with the maximum permissible fuse protection of the inverter when selecting the circuit breaker.

DANGER!

Danger to life due to fire.

When a generator (inverter) and a consumer are connected to the same line circuit breaker, the protective function of the line circuit breaker is no longer guaranteed. The current from the inverter and the grid can accumulate to overcurrent, which is not detected by the line circuit breaker.

- Never connect loads between the inverter and the line circuit breaker without protection.
- Always protect consumers separately.



NOTICE!

Damage to the inverter by using screw type fuse elements as a load disconnection unit!

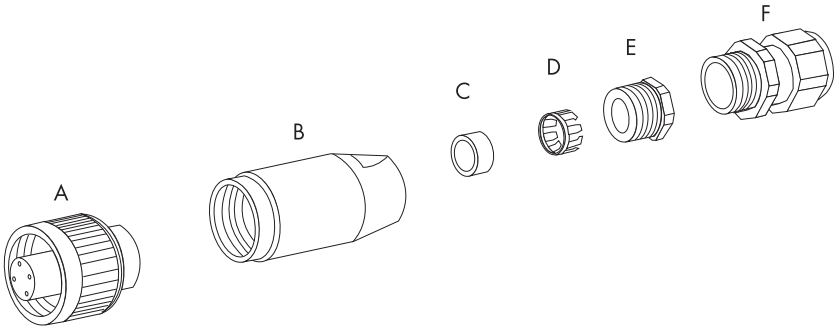
A screw type fuse element, e.g. D system (Diazed) or D0 system (Neozed) is not a circuit breaker, and may **not** be used as a load disconnection unit. A screw type fuse element is only used as cable protection.

When disconnecting under load using a screw type fuse element, the inverter can be damaged.

- Use only a load disconnecting switch or a line circuit breaker as a load disconnecting unit.

5.2.2 Connecting the Inverter to the Public Grid (AC)

Overview AC connection socket

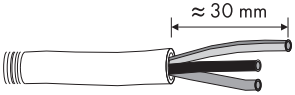


Object	Description
A	Socket element
B	Threaded sleeve
C	Sealing ring PG13.5
D	Fastening case PG13.5
E	Pressure screw for PG 13.5 (for a cable diameter between 9 mm ... 13.5 mm)
F	Cable gland PG 16 (for a cable diameter between 13.5 and 17 mm)

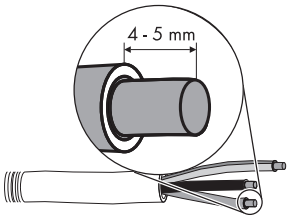
Procedure

1. Choose an appropriate screw fitting for the AC cable.
2. Check the grid voltage and compare with "$V_{AC\ nom}$" on the type label.

   The exact operating range of the inverter is specified in the operating parameters. The corresponding document is located in the download area at www.SMA.de/en, in the "Technical Description" category of the respective inverter.
3. Switch off the line circuit breaker, secure against reconnection, and make sure no voltage is present.
4. Strip approx. 30 mm from the AC cable.
5. Shorten L and N by 5 mm.

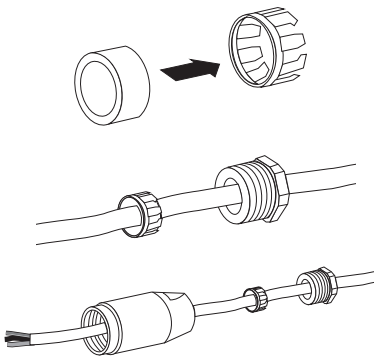


6. Strip the wires of the cable by 4 to 5 mm.

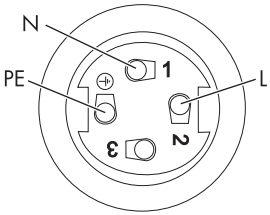


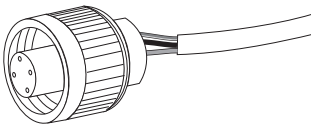
7. Pass the pressure screw and/or cable gland and socket tube over the AC cable.

Size used	Procedure
PG13.5	• Push the sealing ring into the fastening case. • Lead the pressure screw PG13.5 and the fastening case including the sealing ring over the AC cable. • Lead threaded sleeve over the AC cable.
PG16	• Pass the cable gland PG16 over the AC cable. • Lead threaded sleeve over the AC cable.

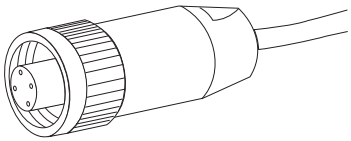


8. Insert the protective earth PE (green-yellow) in the screw terminal with the earth sign on the socket element and tighten the screw.
9. Insert the neutral conductor N (blue) in the screw terminal 1 on the socket and tighten the screw.
10. Place phase L (brown or black) into screw terminal 2 on the socket insert and tighten the screw.
11. Terminal 3 on the socket element remains unused.
12. Make sure the wires are securely connected.

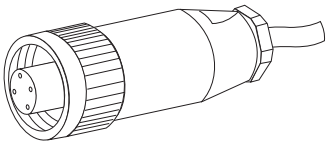
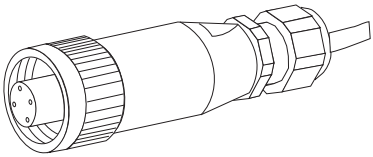




13. Screw the threaded sleeve onto the socket element.

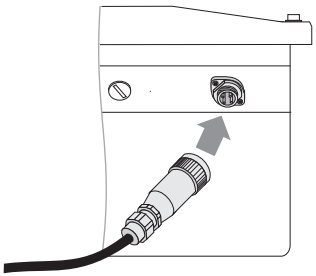


14. Tighten the pressure screw or cable gland tightly onto the threaded sleeve.

Size used	Procedure
PG13.5	 The fastening case along with the sealing ring is pressed into the threaded sleeve and can no longer be seen.
PG16	• Retighten the lock nut of the cable gland. 

☑ The AC connection socket has been screwed together.

15. If the AC connection socket is not immediately connected to the inverter, close the AC socket on the inverter with the protective cap provided.
16. Insert the AC connection socket into the AC socket on the inverter. Remove the protective cap beforehand as required.
17. Turn the threaded ring of the AC connection socket tightly onto the AC socket on the inverter. The threaded ring serves to seal and relieve strain on the AC connection socket.



☑ The AC cable is now connected to the inverter.

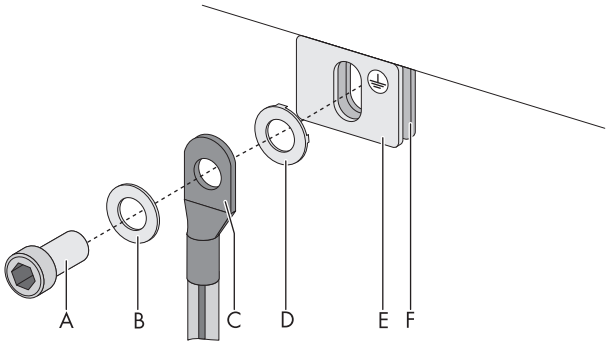
DANGER!
Danger to life due to high voltages in the inverter.

- Do not switch on the line circuit breaker until the PV generator has been connected and the inverter is securely closed.

5.2.3 Connecting additional grounding

If a second grounding conductor, additional grounding or potential equalization is required, you may also ground the inverter on the enclosure.

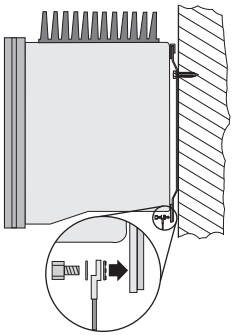
Additional grounding overview



Object	Description
A	M6x12 cylinder head screw (included in the scope of delivery)
B	Washer
C	Terminal lug (M6) with grounding conductor
D	Locking washer (included in scope of delivery)
E	Metal shackle on the underside of the enclosure
F	Wall bracket of the inverter

Procedure

1. Fit the washer, terminal lug with grounding conductor and locking washer onto the cylinder head screw. The toothing of the locking washer must face toward the metal shackle.
2. Insert the cylinder head screw into the metal shackle on the underside of the enclosure and screw into the wall bracket. Tighten the cylinder head screw using a torque of 6 Nm.
3. Check that the contact between the grounding conductor and the enclosure is in accordance with the regulations valid for the country of installation.



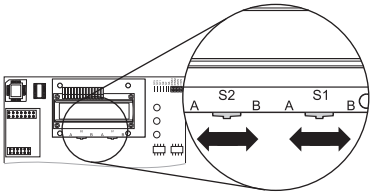
5.3 Setting the Display Language

You can set the language of the display using the switches on the underside of the display assembly inside the inverter.

Procedure

1. Open the inverter as described in section 7.2 "Opening the Inverter" (page 44).
2. Set the switches for the required language, as shown below.

Language	Switch S2	Switch S1
German	B	B
English	B	A
French	A	B
Spanish	A	A



For type SB 1200-IT/1700-IT inverters, the following switch settings apply for firmware version 3.06 and higher:

Language	Switch S2	Switch S1
German	B	B
Italian	B	A
French	A	B
English	A	A

3. Close the inverter as described in section 7.3 "Closing the Inverter" (page 47).

☑ The display language has now been set.

5.4 PV generator connection (DC)

5.4.1 Conditions for the DC Connection

Use of Adaptors

Adaptors (branch connectors) must not be visible or freely accessible in the immediate surroundings of the inverter.

- The DC current flow may not be interrupted via adaptors.
- Observe the procedure for disconnecting the inverter as described in section 7.2 "Opening the Inverter" (page 44).

- Requirements for the PV modules of the connected strings:
  - Same type
  - Same number
  - Identical alignment
  - Identical tilt
- The connecting cables from the PV modules must be fitted with plug connectors. You will find the necessary DC plug connector for DC connection in the delivery.
- The following limiting values at the DC input of the inverter may not be exceeded:

Inverter	Maximum input voltage	Maximum input current
SB 1200	400 V (DC)	12.6 A (DC)
SB 1700	400 V (DC)	12.6 A (DC)

DANGER!

Risk of lethal electric shock or fire.

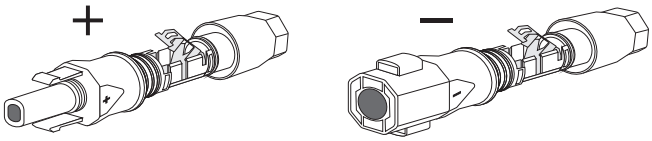
The maximum possible input current per string is limited by the plug connectors used. If the plug connector is overloaded, an electric arc may occur and there is a fire risk.

- Ensure that the input current for each string does not exceed the maximum flow current of the plug connectors used.

5.4.2 Assembling the DC Plug Connector

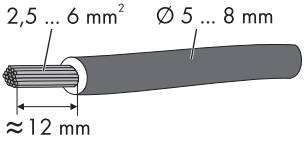
In order to connect to the inverter, all connecting cables of the PV modules must be equipped with the DC plug connectors provided.

To assemble the DC plug connectors, proceed as detailed below. Ensure the plug connectors have the correct polarity. The DC plug connectors are marked with "+" and " – ".



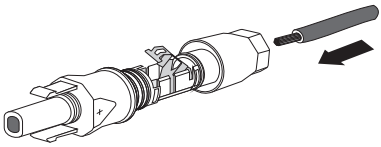
Cable requirements:

- Use a PV1-F cable.

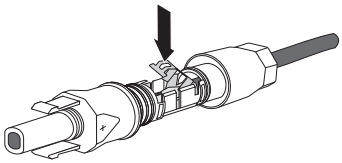


Procedure

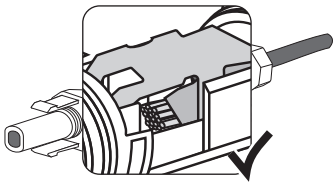
1. Insert stripped cable into the plug up to the limit.

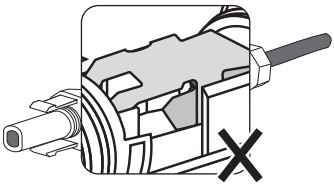
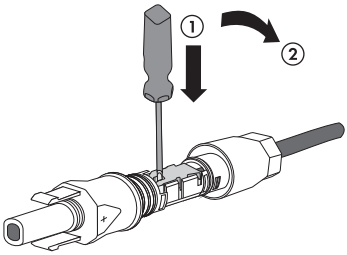


2. Press the clamping clip downward until you hear an audible click.

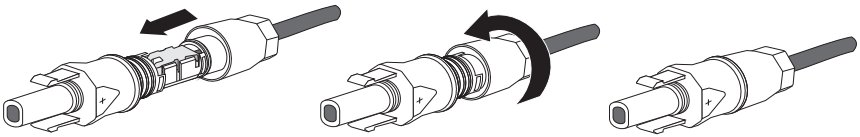


3. Ensure the cable is correctly in place.

Result	Action
☑ If the conductors are visible in the hollow cavity of the clamp, the cable is in the correct position. 	• Proceed to step 4.

Result	Action
☑ If the conductors are **not** visible in the hollow cavity of the clamp, the cable is not in the correct position. 	• Declamp the clamping clip. Use a screwdriver with a width of 3.5 mm.  • Remove cable and start again from step 1.

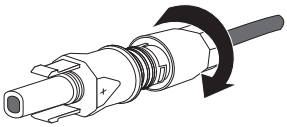
4. Push the threaded joint to the thread and screw into place with a torque of 2 Nm.



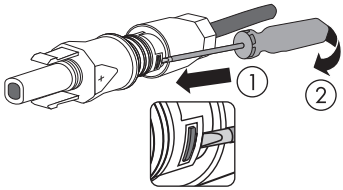
☑ The DC plug connectors are now assembled and can be connected to the inverters, as described in section 5.4.4 "Connecting the PV Generator (DC)" (page 32).

5.4.3 Opening the DC Plug Connector

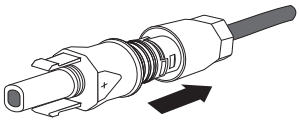
1. Screw the threaded joint off.



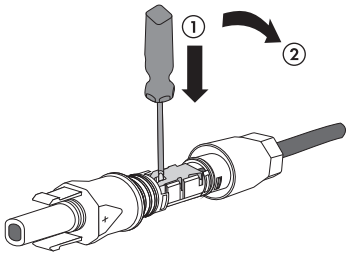
2. To release the plug connector, slot a screw driver into the side catch mechanism and lever out.Use a screwdriver with a width of 3.5 mm.



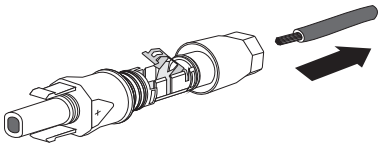
3. Carefully pull the DC plug connector apart.



4. Declamp the clamping clip. Use a screwdriver with a width of 3.5 mm.



5. Remove the cable.



☑ The cable is now removed from the DC plug connector.

5.4.4 Connecting the PV Generator (DC)

DANGER!

Danger to life due to high voltages in the inverter.

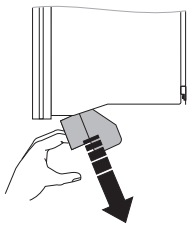
- Before connecting the PV generator, ensure that the line circuit breaker is switched off.

NOTICE!

Excessive voltages can destroy the measuring device.

- Only use measuring devices with a DC input voltage range up to at least 1 000 V.

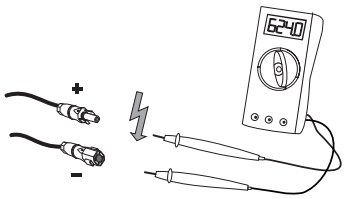
1. Disconnect the line circuit breaker and secure against re-connection.
2. Pull the Electronic Solar Switch downward, slightly toward the wall.



3. Check the connection cables of the PV modules for correct polarity and that the maximum input voltage of the inverter is not exceeded.

   At an ambient temperature above 10 °C, the open circuit voltage of the PV modules must not be more than 90 % of the maximum inverter input voltage.

   Otherwise, check the system design and the PV module connection. If this is not done, the maximum inverter input voltage can be exceeded at low temperatures.



NOTICE!

Exceeding the maximum input voltage can destroy the inverter!

If the voltage of the PV modules exceeds the maximum input voltage of the inverter, it can be destroyed by the overvoltage. All warranty claims become void.

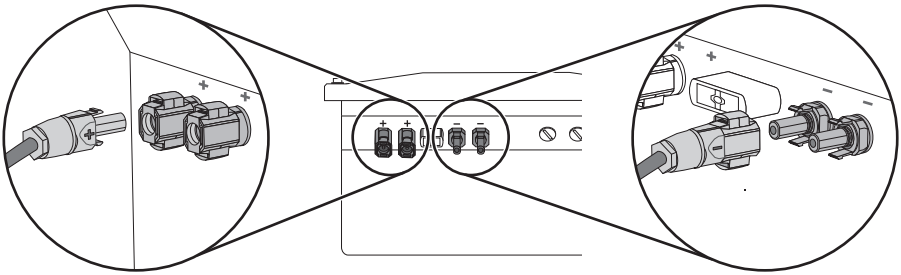
- Do not connect strings with an open circuit voltage greater than the maximum input voltage of the inverter.
- Check the system design.

4. Check the strings for ground faults, as described in section 9.3.1 "Checking the PV Generator for a Ground Fault" (page 56).

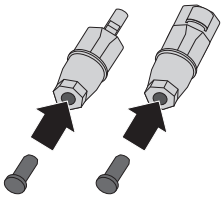
DANGER!
Risk of lethal electric shock.

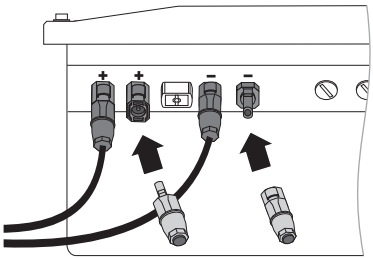
- Do not connect strings with ground faults.
- First, rectify the ground fault in the respective string.

5. Check the DC plug connector for correct polarity and connect it.
   To release the plug connectors see section 7.2 "Opening the Inverter" (page 44).

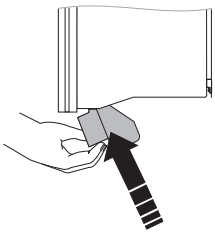


6. To create the sealing on the inverter, all the DC inputs that are not needed must be closed as follows:
   - Insert the sealing plugs provided into the DC plug connectors that are not required.
     Do **not** insert the sealing plus into the DC inputs on the inverter.
   - Insert the DC plug connectors with sealing plugs into the corresponding DC inputs on the inverter.





7. Check the Electronic Solar Switch for wear, as described in section 8.1 "Checking the Electronic Solar Switch for Wear" (page 49) and reattach it firmly.



NOTICE!

Manipulating the connector in the handle can damage the Electronic Solar Switch.

The connector within the handle must remain movable in order to ensure proper contact. Tightening the screw voids all warranty claims and creates a fire risk.

- Do **not** tighten the connector screw in the Electronic Solar Switch handle.

NOTICE!

The Electronic Solar Switch can be damaged if it is inserted incorrectly!

If not plugged correctly, the Electronic Solar Switch can be damaged by high voltages.

- Connect the holder firmly on to the socket of the Electronic Solar Switch.
- Check that the handle is securely in place.

☑ The PV generator is now connected.

5.5 Communication

The inverter is equipped with a slot for communication interfaces in order to communicate with special data acquisition devices (e.g. Sunny WebBox) or a PC with corresponding software (e.g. Sunny Data Control or Sunny Explorer).

Refer to the communication interface manual for a detailed wiring diagram and a description of the mounting.

5.6 Setting the Grid and Country Parameters

Changing Grid-Relevant and Country Parameters

To change grid-relevant parameters, you need a personal access code - the so-called SMA Grid Guard Code. The application form for the personal access code is located in the download area at www.SMA.de/en, in the "Certificate" category for each inverter.

Ensure that you discuss the changes to these parameters with your utility operator.

A detailed description of the operating parameter for the inverter is available in the download area at www.SMA.de/en in the category "Technical Description" of the respective inverter.

5.6.1 Setting the Installation Country

Using the "Default" parameter you can set the installation country and/or the grid connection standard valid for the country via a communication device (e.g. Sunny WebBox) or a PC with appropriate software (e.g. Sunny Data Control or Sunny Explorer). This, however, is only required if the inverter was originally ordered for another country. You can see the standard to which the inverter was set upon delivery from the type label and the supplementary document provided with the factory settings.

5.6.2 Setting Stand-alone Grid Operation

To operate the inverter in a Sunny Island system, you must set the inverter via the "Default" parameter to off-grid ("OFF-Grid") operation.

You have several possibilities to set the inverter to stand-alone grid operation:

- Setting via Sunny WebBox

  or

- Setting via Sunny Data Control or Sunny Explorer.

DANGER!

Danger to life due to high voltages in the event of outage of the power distribution grid.

If you set the inverter to stand-alone grid operation, it does not fulfill any country-specific standards and regulations. Therefore, if there is an outage of the power distribution grid, there is a danger of back-feed.

- **Never** operate the inverter directly on the power distribution grid when set to stand-alone grid operation.

6 Commissioning

6.1 Commissioning the Inverter

1. Check the following requirements before commissioning:
   - The inverter is firmly fastened.
   - Correct connection of the AC cable (grid)
   - Full connection of the DC cables (PV strings)
   - DC inputs that are not needed are closed with the corresponding DC plug connectors and sealing plugs.
   - The enclosure lid is securely screwed in place
   - The Electronic Solar Switch (ESS) is securely plugged
   - The line circuit breaker is laid out correctly
2. Switch on the line circuit breaker.

   ☑ Green LED glows: commissioning has been successful.

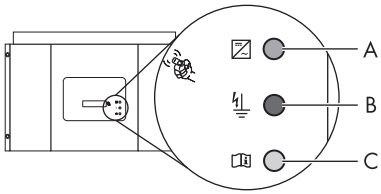
   or

   ☑ Green LED flashes when there is insufficient irradiation: network connection conditions have not yet been reached. Wait for sufficient irradiation.

   or

   ☑ The red or yellow LED is glowing or flashing: there has been an error. Proceed to step 3.

A	Green LED	Operation
B	Red LED	Ground fault or varistor defective
C	Yellow LED	Disturbance



Self test in accordance with DK 5940, Ed. 2.2 for initial commissioning (applies to Italy only)

The Italian DK 5940 standard requires that an inverter can first operate on the power distribution grid when the disconnection times for overvoltage, undervoltage, minimum frequency and maximum frequency have been checked.

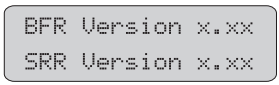
Restart the self-test as described in the following section 6.3 "Self-Test in accordance with DK 5940, Ed. 2.2 (applies to Italy only)" (page 39). The test takes approx. 8 minutes.

3. Read section 9 "Failure Search" (page 51) and if necessary eliminate the fault or disturbance.

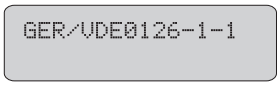
6.2 Display Messages during Initialization

After startup of the inverter, the display shows the inverter type.

After 5 seconds, or when you tap again on the enclosure cover, the firmware version of the internal processors is displayed.



After a further 5 seconds, or when you tap again, the configured country standard is displayed (example: "GER/VDE0126-1-1").



Show display messages again

In order to show the display messages from the initialization phase again during operation,tap twice on the enclosure cover.

6.3 Self-Test in accordance with DK 5940, Ed. 2.2 (applies to Italy only)

6.3.1 Starting the Self-Test by Tapping

You can start testing the disconnection times by tapping on the enclosure lid. Prerequisite here is that the country configuration of the inverter has been set to Italy (IT/DK5940) or "trimmed". Proceed as follows for checking the disconnection times:

1. Connect the PV generator with the inverter. The inverter can only initialize if the PV generator produces enough power. It is therefore not possible to test the disconnection times at night.
2. Connect the inverter on the AC side. For this, you have to create the AC connection (AC plug or direct connection) and/or switch on the line circuit breaker of the grid cable (fuse or automatic circuit breaker).
3. The inverter is now in the initialization phase, i.e. all 3 LEDs are glowing at the same time.

   Start the self-test **immediately** after all 3 LEDS have gone out by tapping once on the display of the inverter.
4. The question on whether you would like to start the test sequence appears in the display. Tap on the display again within 30 seconds in order to confirm the question.

Once you have started the test sequence, the inverter checks the disconnection times for overvoltage, undervoltage, maximum frequency and minimum frequency one after the other. During the tests, the inverter shows the values in the display which are described in section 6.3.2 "Completion of the Self-Test" (page 39).

6.3.2 Completion of the Self-Test

Note the values which are displayed during the self-test. These values must be entered into a test protocol. The test results of the individual tests are displayed 3 times one after the other. The respective display message is displayed for 10 seconds. During the test sequence, the inverter will not react to tapping.

The self-test changes the upper and lower shut-down thresholds for each protective function on a linear basis with a modification of 0.05 Hz/s and 0.05 Vn/s for the frequency and voltage monitoring. As soon as the actual measurement value is outside the permitted range (altered shut-down threshold), the inverter disconnects itself from the grid. In this way, the inverter determines the reaction time and checks itself.

Overvoltage Test

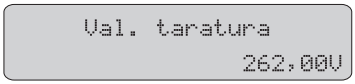
The inverter begins with the overvoltage test. During the test sequence, the voltage limit applied is shown in the display of the inverter.

The voltage limit is reduced successively until the shut-down threshold is achieved and the inverter disconnects from the grid.

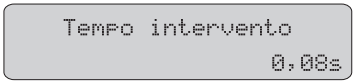
Once the inverter has disconnected from the grid, the display successively shows the following values one after the other:

- Disconnection value,

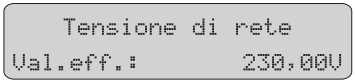
- Calibration value,



- Reaction time,



- Present grid voltage.



Undervoltage Test

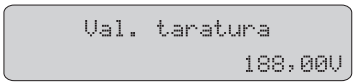
After the overvoltage test, the inverter performs the undervoltage test. During the test sequence, the current calibration value of the voltage limit applied is shown in the display of the inverter.

The voltage limit is increased successively until the shut-down threshold is achieved and the inverter disconnects from the grid.

Once the inverter has disconnected from the grid, the display successively shows the following values one after the other:

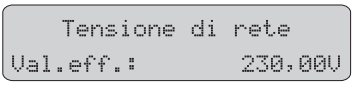
- Disconnection value,

- Calibration value,



- Reaction time,

- Present grid voltage.



Maximum Frequency

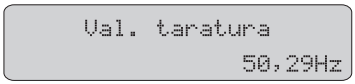
In the third step, the inverter tests the maximum frequency. During the test sequence, the frequency limit applied is shown in the display of the inverter.

The frequency limit is reduced successively until the shut-down threshold is achieved and the inverter disconnects from the grid.

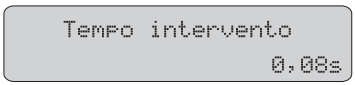
Once the inverter has disconnected from the grid, the display successively shows the following values one after the other:

- Disconnection value,

- Calibration value,



- Reaction time,



- Present grid frequency.

Minimum Frequency

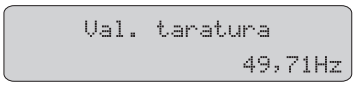
In the last step, the inverter tests the minimum frequency. During the test sequence, the frequency limit applied is shown in the display of the inverter.

The frequency limit is increased successively until the shut-down threshold is achieved and the inverter disconnects from the grid.

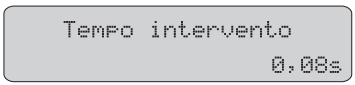
Once the inverter has disconnected from the grid, the display successively shows the following values one after the other:

- Disconnection value,

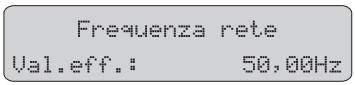
- Calibration value,



- Reaction time,



- Present grid frequency.



When the inverter has carried out the 4 tests, it switches to MPP operation mode ("MPP"). The original calibration values are then re-set and the inverter automatically connects to the grid. If you would like to carry out the test again, you have to disconnect the inverter, in other words you have to disconnect it on the AC and DC sides and then later re-activate it. You can then restart the self-test as described in the following section 6.3.1 "Starting the Self-Test by Tapping" (page 39). The inverter begins the test sequence again, as described in section 6.3.2 "Completion of the Self-Test" (page 39).

7 Opening and Closing

7.1 Safety

DANGER!

Risk of lethal electric shock.

Observe the following before opening the inverter:

- Ensure the AC side is not live.
- Ensure the DC side is not live.

NOTICE!

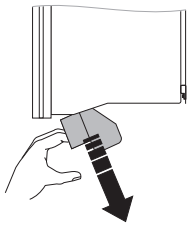
Electrostatic discharges can damage the inverter!

Internal components of the inverter can be irreparably damaged by electrostatic discharge.

- Ground yourself before touching a component.

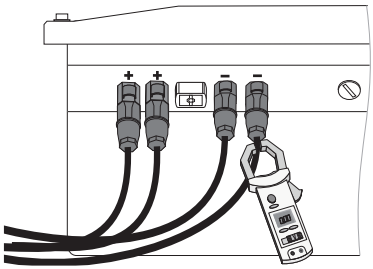
7.2 Opening the Inverter

1. Disconnect the line circuit breaker and secure against re-connection.
2. Pull the Electronic Solar Switch downwards, slightly towards the wall.

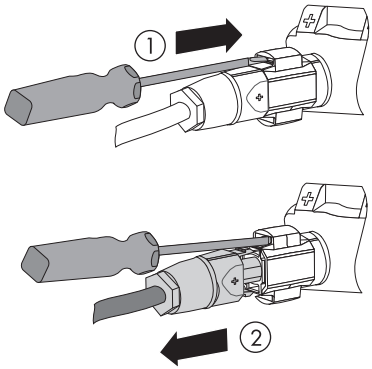


3. Using a current probe, ensure that there is no current to all DC cables.

   ☑ If there is a current present, check the installation.



4. Unlock all the DC plug connectors: Use a screwdriver with a width of 3.5 mm.
   - Insert a screwdriver into one of the side slits (1).
   - Disconnect the DC plug connectors (2).

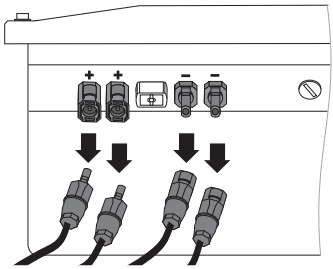


DANGER!

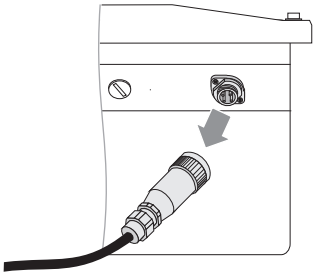
Danger to life due to unsafe disconnection from the PV generator!

A secure separation from the PV generator is only guaranteed after pulling off the Electronic Solar Switch **and** all DC plug connectors.

- Remove all DC plug connectors to completely disconnect the PV generator from the inverter.



5. Pull out the AC plug.



6. Check whether all LEDs and the display have gone out.

DANGER!

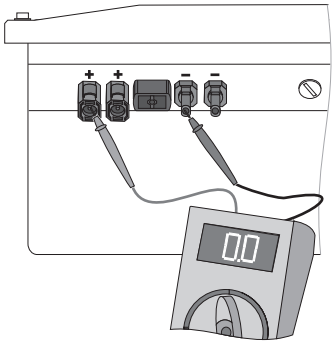
Danger to life due to high voltages in the inverter.

The capacitors in the inverter require 15 minutes to discharge.

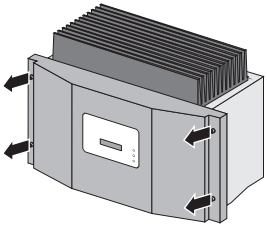
- Wait 15 minutes before opening the inverter.

7. Ensure that there is no voltage at the DC plugs at the inverter.

   ☑ If there is a voltage present, check the installation.



8. Remove all screws from the enclosure lid and pull the lid forward smoothly.

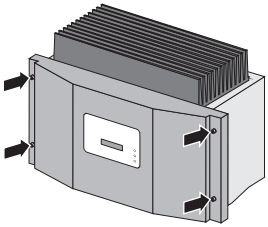


9. Remove the protective conductor (PE) connection from the lid by loosening the locking device of the PE connection on the lid.

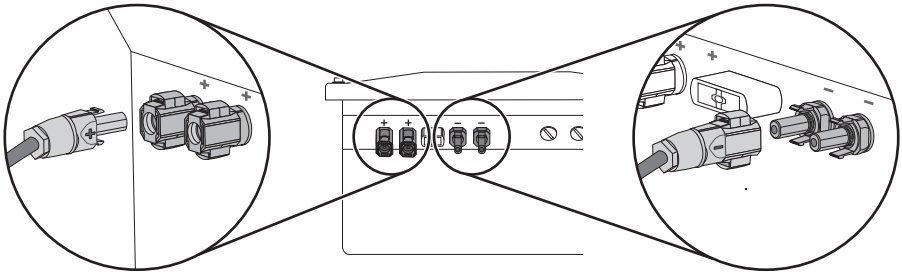
☑ The inverter is now open and is not live.

7.3 Closing the Inverter

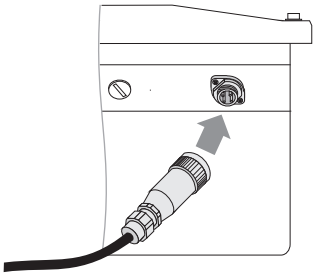
1. Reconnect the protective conductor (PE) connection to the enclosure lid.
2. Secure the enclosure lid of the inverter by evenly tightening the 4 lid screws.



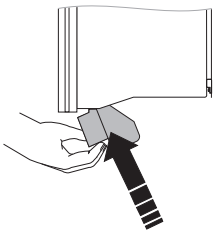
3. Check the DC plug connector for correct polarity and connect it.
   To release the plug connectors see section 7.2 "Opening the Inverter" (page 44).



4. Close all unnecessary DC inputs as described in section 5.4.4 "Connecting the PV Generator (DC)" (page 32) to seal the inverter.
5. Pull out the AC plug.



6. Check the Electronic Solar Switch for wear, as described in section 8.1 "Checking the Electronic Solar Switch for Wear" (page 49) and reattach it firmly.



NOTICE!

Manipulating the connector in the handle can damage the Electronic Solar Switch.

The connector within the handle must remain movable in order to ensure proper contact. Tightening the screw voids all warranty claims and creates a fire risk.

- Do **not** tighten the connector screw in the Electronic Solar Switch handle.

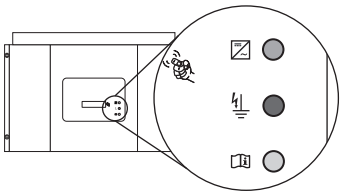
NOTICE!

The Electronic Solar Switch can be damaged if it is inserted incorrectly!

If not plugged correctly, the Electronic Solar Switch can be damaged by high voltages.

- Connect the holder firmly on to the socket of the Electronic Solar Switch.
- Check that the handle is securely in place.

7. Switch on the line circuit breaker.
8. Check whether the display and the LEDs indicate normal operating mode (see section 6 "Commissioning" (page 37)).



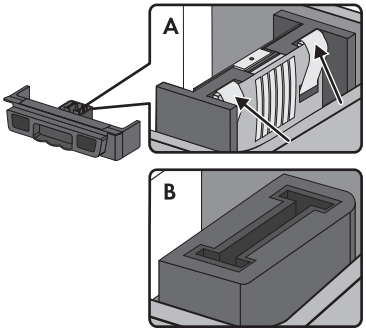
☑ The inverter is now closed and in operation.

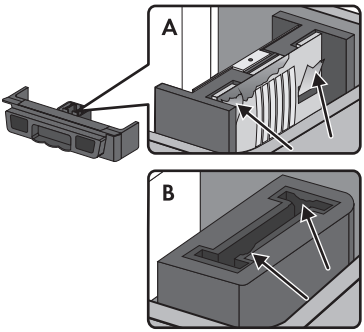
8 Maintenance and Cleaning

Check for proper inverter operation at regular intervals. Impurities such as dust or pollen can cause heat accumulation that can lead to yield losses. Also check the inverters and the cables for visible external damage. Undertake repairs if necessary.

8.1 Checking the Electronic Solar Switch for Wear

Check the Electronic Solar Switch for wear before plugging it in. Depending on the shape of the Electronic Solar Switch, you can estimate the wear on either the metal tongues (shape A) or on the plastic (shape B).

Result	Action
☑ The metal tongues in the Electronic Solar Switch are undamaged and not discolored (A). **or** ☑ The plastic in the Electronic Solar Switch is undamaged (B). 	1. Securely attach the Electronic Solar Switch handle. 2. Commission the inverter as described in section 6 "Commissioning" (page 37).

Result	Action
☑ The metal tongues in the Electronic Solar Switch have a brown discoloration or are burned through (A). **or** ☑ The plastic in the Electronic Solar Switch shows thermal deformation (B). 	The Electronic Solar Switch can no longer reliably disconnect the DC side. 1. Replace the Electronic Solar Switch handle before attaching it again (for the order number see section 12 "Accessories" (page 68). 2. Commission the inverter as described in section 6 "Commissioning" (page 37).

9 Failure Search

If the inverter displays blink codes or error messages other than those described in the following section, contact the SMA Serviceline.

In the user manual provided, you will also find a description of the display messages during operation, the status messages and measuring channels.

Do not try to carry out repairs other than those described here. Instead, use the SMA Solar Technology AG 24-hour replacement service (the inverter will be ready for dispatch within 24 hours and sent to a forwarding agency) and repair service

9.1 LED Codes

Green	Red	Yellow	Status
Glows continuously	Is not glowing	Is not glowing	OK (feeding operation)
	Glows continuously	Is not glowing	Ground fault or varistor defective
		Glows continuously	OK (initialization)
Flashes quickly (3 x per second)	Is not glowing	Is not glowing	OK (stop)
	Glows continuously	Is not glowing	Ground fault or varistor defective
Flashes slowly (1 x per second)	Is not glowing	Is not glowing	OK (waiting, grid monitoring)
	Glows continuously	Is not glowing	Ground fault or varistor defective
Briefly goes out (Approx. 1x per second)	Is not glowing	Is not glowing	OK (derating)
	Glows continuously	Is not glowing	Ground fault or varistor defective
Is not glowing	Is not glowing	Is not glowing	OK (nighttime deactivation)
		Glowing/flashing	Disturbance
	Glows continuously	Is not glowing	Ground fault or varistor defective
		Glowing/flashing	Ground fault or varistor defective and disturbance

9.2 Error Messages

When a disturbance occurs, the inverter generates a message, which depends on the operating mode and the type of the detected disturbance.

Message	Description and corrective measure
!PV-Overvoltage! **!DISCONNECT DC!**	Overvoltage at DC input. Overvoltage can destroy the inverter.
	Corrective measures Disconnect the inverter from the grid immediately. 1. Turn off the line circuit breaker. 2. Remove the Electronic Solar Switch. 3. Disconnect all the DC plug connectors. 4. Check DC voltage: – If the DC voltage exceeds the maximum input voltage, check the plant design or contact the person who installed the PV generator. – If the DC voltage is under the maximum input voltage, reconnect the inverter to the PV generator as described in section 5.4 "PV generator connection (DC)" (page 28). If the message occurs again, disconnect the inverter again and contact the SMA Serviceline (see section 13 "Contact" (page 69)).
ACVtgRPro	The 10-minute-average grid voltage is no longer within the permissible range. This can have the following causes: • The grid voltage at the connection point is too high. • The grid impedance at the connection point is too high. The inverter disconnects to assure compliance with the voltage quality of the grid.
	Corrective measures Check the grid voltage at the connection point of the inverter: • If, due to the local grid conditions, the grid voltage is 253 V or more, ask the utility operator whether the voltage at the feed-in point can be adjusted, or whether it would agree to an alteration of the threshold value of the ACVtgRPro parameter to monitor the voltage quality. • If the grid voltage is continually within the acceptable range and this error is still displayed, contact the SMA Serviceline.
Bfr-Srr	Internal measurement comparison fault or hardware defect.
	Corrective measures • If this fault occurs often, contact the SMA Serviceline.

Message	Description and corrective measure
EEPROM	Transition disturbance while data is being written or read from EEPROM. The data is not relevant for safe operation The disturbance has no effect on the performance of the inverter.
EEPROM dBh	EEPROM data is defective, the device has switched off because the loss of data has disabled important functions of the inverter.
	Corrective measures • Contact the SMA Serviceline.
EeRestore	One of the duplicate data sets in the EEPROM is defective and has been reconstructed without loss of data. • The error message only serves to inform you and has no effect on the performance of the inverter.
Fac-Bfr **Fac-Srr** **FacFast**	The grid frequency is no longer within the permissible range ("Bfr" or "Srr" is an internal message of no relevance for the user). For safety reasons, the inverter disconnects itself from the grid.
	Corrective measures • Check the grid connection and contact the utility operator if necessary • If the grid frequency is within the tolerance range, yet "Fac-Bfr", "Fac-Srr" or "FacFast" faults are still being displayed, contact the SMA Serviceline.
Imax **overcurrent**	Overcurrent on the AC side. This fault code is displayed if the current in the AC grid is larger than specified.
	Corrective measures • Check the system design and grid conditions.
K1-Close **K1-Open**	Fault during relay test.
	Corrective measures • Contact the SMA Serviceline if this problem occurs often or several times in succession.
MSD-FAC **MSD-VAC** **MSD-Timeout**	Internal measurement comparison fault or hardware defect.
	Corrective measures • If this fault occurs often, contact the SMA Serviceline.
Offset	The "Offset" operating condition is a normal operating condition that occurs prior to grid monitoring. If "Offset" is displayed as an error, then there is a disturbance in the data logging.
	Corrective measures • If this fault occurs often, contact the SMA Serviceline.

Message	Description and corrective measure
Riso	The electrical insulation between the PV plant and ground is faulty. The resistance between the DC plus and/or DC minus connection and ground is outside the defined limit range.
	Corrective measures • Check the plant insulation. • Check the plant for ground faults as described in section 9.3.1 "Checking the PV Generator for a Ground Fault" (page 56).
ROM	The inverter's firmware is faulty.
	Corrective measures • If this fault occurs often, contact the SMA Serviceline.
Shutdown	Temporary inverter fault.
	Corrective measures • Contact the SMA Serviceline.
Vac-Bfr **Vac-Srr**	The grid voltage is no longer within the permissible range ("Bfr" or "Srr" is an internal message of no relevance for the user). This code can be caused by any of the following conditions: • Grid disconnected (line circuit breaker, fuse), • AC cable is broken or • AC cable is highly resistive For safety reasons, the inverter disconnects itself from the grid.
	Corrective measures • Check the grid current and grid connection on the inverter. • If the grid voltage lies outside the acceptable range because of local grid conditions, ask the utility provider if the voltage can be adjusted at the feed-in point or if it would agree to changes in the values of the monitored operational limits (operating parameters: Uac-Min and Uac-Max). • If the grid frequency is within the tolerable range, yet "Vac-Bfr," or "Vac-Srr" faults are still being displayed, please contact the SMA Serviceline.

Message	Description and corrective measure
VpvMax **Vpv-Max**	Overvoltage at DC input. The inverter may be damaged. **Corrective measures** Immediately disconnect the inverter from the grid. 1. Turn off the line circuit breaker. 2. Remove the Electronic Solar Switch. 3. Disconnect all the DC plug connectors. 4. Check DC voltage: – If the DC voltage exceeds the maximum input voltage, check the plant design or contact the person who installed the PV generator. – If the DC voltage is under the maximum input voltage, reconnect the inverter to the PV generator as described in section 5.4 "PV generator connection (DC)" (page 28). If the message occurs again, disconnect the inverter again and contact the SMA Serviceline (see section 13 "Contact" (page 69)).
Watchdog **Watchdog Srr**	Internal program run fault. **Corrective measures** • If this fault occurs often, contact the SMA Serviceline.

9.3 Red LED is Glowing Continuously

If the red LED of the status display is continuously on during operation, there is either a ground fault in the PV generator or at least one of the varistors for the overvoltage protection is defective.

Procedure

1. Check for ground faults in the PV generator as described in section 9.3.1 "Checking the PV Generator for a Ground Fault" (page 56).
2. If the red LED continues to glow, check the varistors as described in section 9.3.2 "Checking the Functioning of the Varistors" (page 58).

9.3.1 Checking the PV Generator for a Ground Fault

1. Disconnect the inverter from both the DC and AC connections as described in section 7.2 "Opening the Inverter" (page 44).

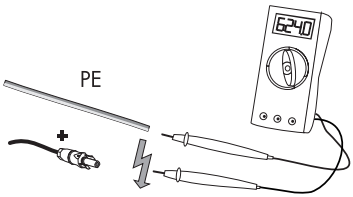
DANGER!
Risk of lethal electric shock.

- Only touch the cables of the PV generator on their insulation.
- Do not connect strings with ground faults to the inverter.

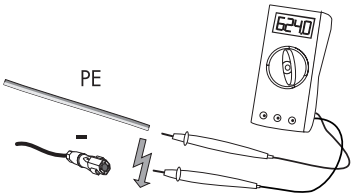
NOTICE!
Excessive voltages can destroy the measuring device.

- Only use measuring devices with a DC input voltage range up to at least 1 000 V.

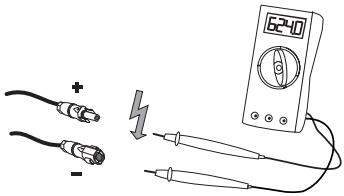
2. Measure the voltages between the positive pole of the strings and the ground potential (PE).



3. Measure the voltages between the minus pole of the strings and the ground potential (PE).



4. Measure the voltages between the plus pole and the minus pole of each string.



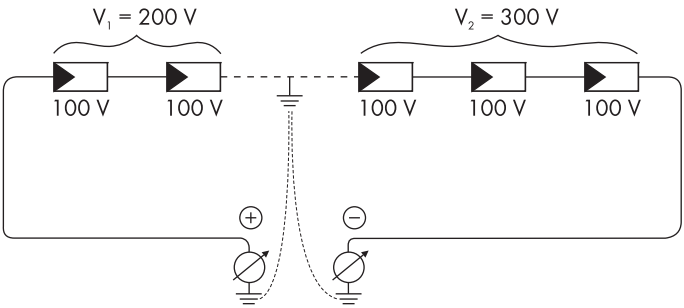
☑ If the voltages measured are stable and the total of the voltages from the plus pole against ground potential and the minus pole against ground potential of a string roughly corresponds to the voltage between the plus pole and minus pole, then there is a ground fault.

Result	Action
☑ You have found **a ground fault**.	• The installer of the PV generator must remedy the ground fault in the affected string. You can determine the location of the ground fault as described below. • Do **not** reconnect the faulty string. • Close the inverter and commission it as described in section 6.1 "Commissioning the Inverter" (page 37).
☑ You have found **no ground fault**.	It is likely that one of the thermally monitored varistors is defective. • Check the varistors as described in section 9.3.2 "Checking the Functioning of the Varistors" (page 58).

Location of the ground fault

The approximate position of the ground fault can be determined from the ratio of the measured voltages between the plus pole against ground potential and the minus pole against ground potential (PE).

Example:



In this case, the ground fault is between the second and third PV module.

☑ The ground fault check is finished.

9.3.2 Checking the Functioning of the Varistors

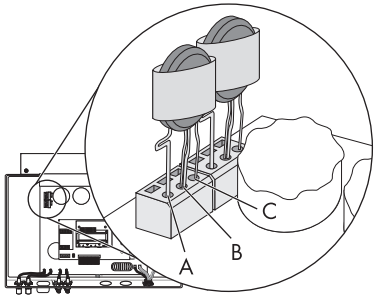
Varistors are wear parts. Their functional efficiency diminishes with age or following repeated responses as a result of overvoltages. It is therefore possible that one of the thermally monitored varistors has lost its protective function, and thus the red LED is lit.

Position of Varistors

You can determine the position of the varistors using the illustration below.

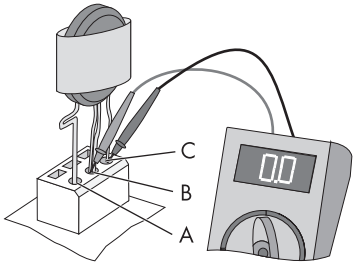
Observe the following allocation of the terminals:

- Terminal A: outer terminal (varistor connection **with loop** [crimp])
- Terminal B: middle terminal
- Terminal C: outer terminal (varistor connection **without loop** [crimp])



Check the function of the varistors as described below:

1. Open the inverter as described in section 7.2 "Opening the Inverter" (page 44).
2. With the aid of a multimeter, determine for both varistors in the installed state whether a conductive connection exists between connectors B and C.



Result	Action
☑ There is a **conducting** connection.	There is probably a different fault in the inverter. • Contact the SMA Serviceline (see section 13 "Contact" (page 69)).

Result	Action
☑ There is **no conducting** connection.	The respective varistor is not working and must be replaced. Varistor failure is generally due to influences which affect all varistors similarly (temperature, age, induced overvoltage). SMA Solar Technology AG recommends that you replace both varistors. The varistors are specially manufactured for use in the inverter and are not commercially available. They must be ordered directly from SMA Solar Technology AG (see section 12 "Accessories" (page 68)). • To replace the varistors, proceed to step 3.

NOTICE!

Destruction of the inverter due to overvoltage.

If varistors are missing, the inverter is no longer protected against overvoltages.

- Replacement varistors should be obtained as soon as possible.
- Do **not** operate the inverter without varistors in plants with a high risk of overvoltages.

3. Insert an insertion tool into the openings of the terminal contacts (1).

   ☑ The terminal clamps loosen.

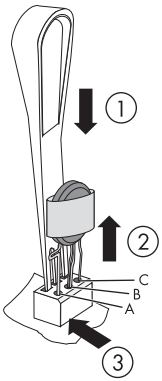
   If you do not receive an insertion tool for operating the terminal clamps with your replacement varistors, contact SMA Solar Technology AG. As an alternative, the individual terminal contacts can be operated using a 3.5 mm wide screwdriver.

4. Remove the varistor (2).
5. Insert new varistor (3).

   The pole with the small loop (crimp) must be fitted to terminal A when remounting.

6. Close the inverter as described in section 7.3 "Closing the Inverter" (page 47).

☑ The check and replacement of the varistors is completed.



10 Decommissioning

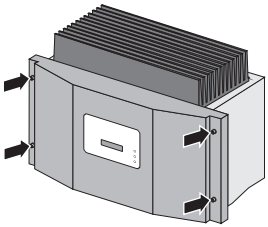
10.1 Dismantling the Inverter

CAUTION!

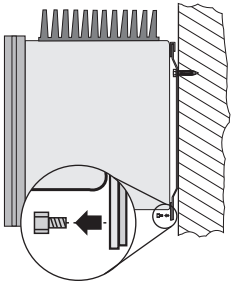
Risk of injury due to the heavy weight of the inverter.

- Remember that the inverter weighs approx. 25 kg.

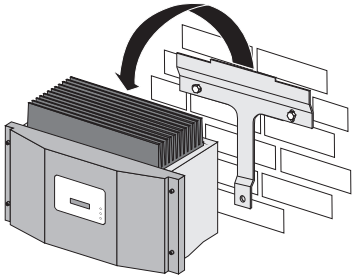
1. Open the inverter as described in section 7.2 "Opening the Inverter" (page 44).
2. Remove all cables from the inverter.
3. Close the inverter with the 4 screws.



4. Loosen the lower screw between the inverter und wall mounting bracket.



5. Remove the inverter upward from the wall mounting bracket.



☑ The inverter is dismantled.

10.2 Packing the Inverter

If possible, always pack the inverter in its original packaging. If it is no longer available, you can also use an equivalent box. The box must be capable of being closed completely and made to support both the weight and the size of the inverter.

10.3 Storing the Inverter

Store the inverter in a dry place where ambient temperatures are always between − 25 °C and +60 °C.

10.4 Disposing of the Inverter

Dispose of the inverter at the end of its service life in accordance with the disposal regulations for electronic waste which apply at the installation site at that time. Alternatively, send it back to SMA Solar Technology AG with shipping paid by sender, and labeled "ZUR ENTSORGUNG" ("for disposal") (see section 13 "Contact" (page 69)).

11 Technical Data

11.1 Sunny Boy 1200

DC Input

Maximum DC power at cos ϕ = 1	P_{DC}	1 320 W
Maximum DC voltage *	$V_{DC\ max}$	400 V
MPP voltage range at 230 V AC	V_{PV}	100 V ... 320 V
DC nominal voltage	$V_{DC\ nom}$	120 V
Minimum DC voltage at 230 V AC	$V_{DC\ min}$	100 V
Start voltage, adjustable	$V_{PV\ Start}$	120 V
Maximum input current	$I_{PV\ max}$	12.6 A
Number of MPP trackers		1
Maximum number of parallel strings		2
Voltage ripple of input voltage	V_{pp}	< 10 %
Internal consumption during operation		< 4 W

The maximum open circuit voltage, which can occur at a cell temperature of – 10 °C, may not exceed the maximum input voltage.

AC Output

AC nominal power at 230 V AC, 50 Hz	$P_{AC\ nom}$	1 200 W
Maximum AC apparent power	$S_{AC\ max}$	1 200 VA
Nominal AC current	$I_{AC\ nom}$	5.2 A
Maximum output current	$I_{AC\ max}$	6.1 A
Maximum fuse protection		16 A
Harmonic distortion of output current at AC THD voltage < 2 %, AC power > 0.5 AC nominal power	K_{IAC}	< 3 %
Nominal AC voltage	$V_{AC\ nom}$	220 V / 230 V / 240 V
AC voltage range	V_{AC}	180 V ... 265 V
AC grid frequency	$f_{AC\ nom}$	50 Hz / 60 Hz
Operating range at AC grid frequency	f_{AC}	50 Hz: 45.5 Hz ... 54.5 Hz 60 Hz: 55.5 Hz ... 64.5 Hz
Power factor at nominal AC power	cos ϕ	1
Overvoltage category		III
Test voltage at 50 Hz		1.7 kV
Surge testing voltage		4 kV
Surge testing voltage with serial interface		6 kV
Internal consumption in night mode		0.1 W

Mechanical data

Width x height x depth	440 mm x 339 mm x 214 mm
Weight	23 kg

Climatic Conditions

Extended temperature range *	− 25 °C ... +60 °C
Extended humidity range *	0 % ... 100 %
Extended air pressure range *	79.5 kPa ... 106 kPa
Temperature range **	− 25 °C ... +70 °C
Operation temperature range	− 25 °C ... +60 °C
Maximum operating altitude above mean sea level	2 000 m

* according to DIN EN 50178:1998-04, installation type C, class 4K4H

** according to DIN EN 50178:1998-04, transport type E, class 2K3

Features

Topology	LF transformer

General data

Protection rating according to DIN EN 60529	IP65
Protection class	I
Noise emission (typical)	≤ 41 dB(A)

Protective equipment

All-pole DC switch-disconnector	Electronic Solar Switch, DC plug system SUNCLIX
DC overvoltage protection	Thermally monitored varistors
Personal protection (R_{iso} > 1 M Ω)	Insulation monitoring
Pole confusion protection	Short circuit diode
AC short circuit protection	Current control
All-pole AC disconnection unit	Automatic disconnection device SMA Grid Guard 2.1, double design

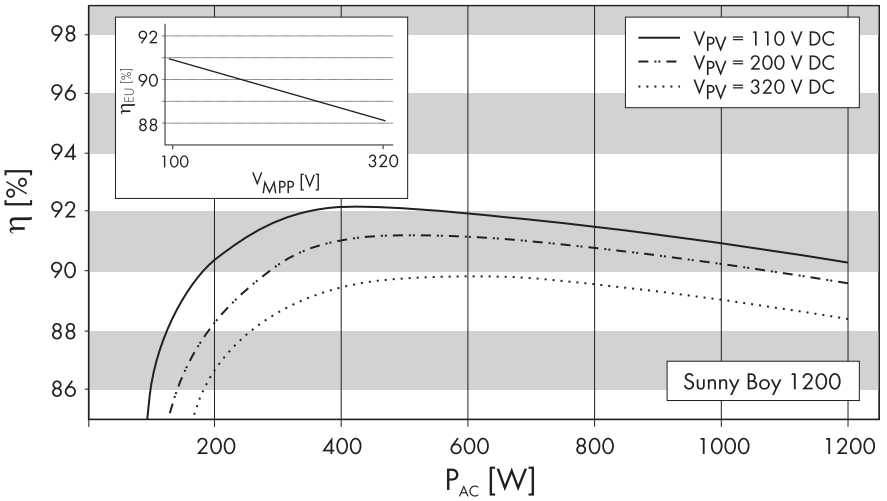
Communication Interfaces

Bluetooth® Wireless Technology	Optional
Radio	Optional
RS485, galvanically isolated	Optional

Electronic Solar Switch

Electrical service life in the event of a short circuit, with a nominal current of 35 A	A minimum of 50 switching operations
Maximum switching current	35 A
Maximum switching voltage	800 V
Maximum PV power	12 kW
Protection rating when plugged	IP65
Protection rating when unplugged	IP21

Efficiency



Peak efficiency	η_{max}	92.1 %
European efficiency	η_{EU}	90.9 %

11.2 Sunny Boy 1700

DC Input

Maximum DC power at cos ϕ = 1	P_{DC}	1 850 W
Maximum DC voltage *	$V_{DC\ max}$	400 V
MPP voltage range at 230 V AC	V_{PV}	147 V ... 320 V
DC nominal voltage	$V_{DC\ nom}$	180 V
Minimum DC voltage at 230 V AC	$V_{DC\ min}$	139 V
Start voltage, adjustable	$V_{PV\ Start}$	180 V
Maximum input current	$I_{PV\ max}$	12.6 A
Number of MPP trackers		1
Maximum number of parallel strings		2
Voltage ripple of input voltage	V_{pp}	< 10 %
Internal consumption during operation		< 4 W

The maximum open circuit voltage, which can occur at a cell temperature of – 10 °C, may not exceed the maximum input voltage.

AC Output

AC nominal power at 230 V AC, 50 Hz	$P_{AC\ nom}$	1 550 W
Maximum AC apparent power	$S_{AC\ max}$	1 700 VA
Nominal AC current	$I_{AC\ nom}$	6.7 A
Maximum output current	$I_{AC\ max}$	8.6 A
Maximum fuse protection		16 A
Harmonic distortion of output current at AC THD voltage < 2 %, AC power > 0.5 AC nominal power	K_{IAC}	< 3 %
Nominal AC voltage	$V_{AC\ nom}$	220 V / 230 V / 240 V
AC voltage range	V_{AC}	180 V ... 265 V
AC grid frequency	$f_{AC\ nom}$	50 Hz / 60 Hz
Operating range at AC grid frequency	f_{AC}	50 Hz: 45.5 Hz ... 54.5 Hz 60 Hz: 55.5 Hz ... 64.5 Hz
Power factor at nominal AC power	cos ϕ	1
Overvoltage category		III
Test voltage at 50 Hz		1.7 kV
Surge testing voltage		4 kV
Surge testing voltage with serial interface		6 kV
Internal consumption in night mode		0.1 W

Mechanical data

Width x height x depth	440 mm x 339 mm x 214 mm
Weight	25 kg

Climatic Conditions

Extended temperature range *	− 25 °C ... +60 °C
Extended humidity range *	0 % ... 100 %
Extended air pressure range *	79.5 kPa ... 106 kPa
Temperature range **	− 25 °C ... +70 °C
Operation temperature range	− 25 °C ... +60 °C
Maximum operating altitude above mean sea level	2 000 m

* according to DIN EN 50178:1998-04, installation type C, class 4K4H

** according to DIN EN 50178:1998-04, transport type E, class 2K3

Features

Topology	LF transformer

General data

Protection rating according to DIN EN 60529	IP65
Protection class	I
Noise emission (typical)	≤ 46 dB(A)

Protective equipment

All-pole DC switch-disconnector	Electronic Solar Switch, DC plug system SUNCLIX
DC overvoltage protection	Thermally monitored varistors
Personal protection (R_{iso} > 1 M Ω)	Insulation monitoring
Pole confusion protection	Short circuit diode
AC short circuit protection	Current control
All-pole AC disconnection unit	Automatic disconnection device SMA Grid Guard 2.1, double design

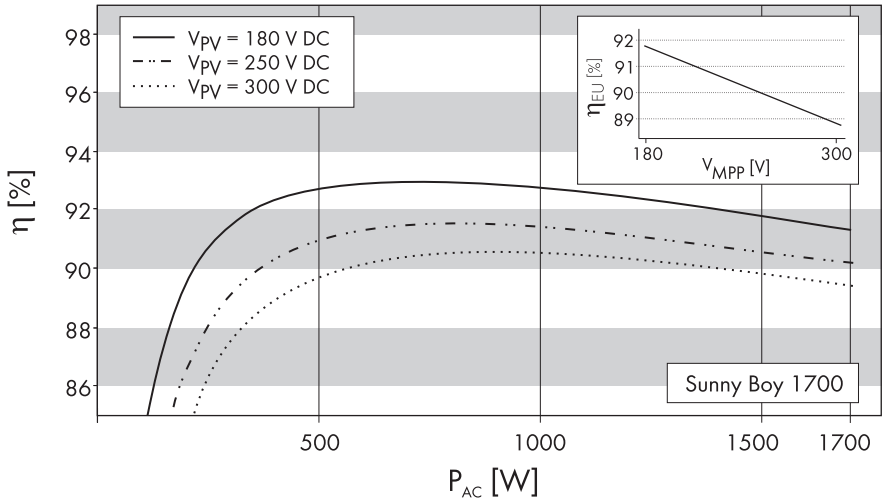
Communication Interfaces

Bluetooth	Optional
Radio	Optional
RS485, galvanically isolated	Optional

Electronic Solar Switch

Electrical service life in the event of a short circuit, with a nominal current of 35 A	A minimum of 50 switching operations
Maximum switching current	35 A
Maximum switching voltage	800 V
Maximum PV power	12 kW
Protection rating when plugged	IP65
Protection rating when unplugged	IP21

Efficiency



Peak efficiency	η_{max}	93.5 %
European efficiency	η_{EU}	91.8 %

12 Accessories

You will find the corresponding accessories and replacement parts for your product In the following overview. If required, you can order these from SMA Solar Technology AG or your dealer.

Description	Brief description	SMA order number
Electronic Solar Switch	ESS handle replacement part	ESS-HANDLE:01 Also enter the inverter's serial number.
Replacement varistors	Set of thermally monitored varistors (2 pcs.) including insertion tool	SB-TV3
Insertion tool for replacing the varistors	Insertion tool for varistor sets	SB-TVWZ
Positive grounding set	Upgrade kit for the positive connection to ground of the DC input	ESHV-P-NR
Negative grounding set	Upgrade kit for the negative connection to ground of the DC input	ESHV-N-NR
RS485 upgrade kit	RS485 interface	485PB-NR
Radio upgrade kit	Radio Piggy-Back for upgrading an inverter for communication with Sunny Beam, including antenna, coaxial cable, and PG cable gland (metal)	BEAMPB-NR
Bluetooth upgrade kit	*Bluetooth* interface	BTPBINV-NR
SUNCLIX DC plug connector	Field plug for conductor cross sections of 2.5 mm^2 ... 6 mm^2	SUNCLIX-FC6-SET

13 Contact

If you have technical problems concerning our products, contact the SMA Serviceline. We require the following information in order to provide you with the necessary assistance:

- Inverter type
- Inverter serial number
- Type and number of PV modules connected
- Optional equipment, e.g. communication devices
- Blink code or display of inverter

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SMA Serviceline

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